Design + Optimization + Fabrication

Learning objective:

This 5 day workshop will provide students and professionals a functional understanding of Rhino and Grasshopper concepts, necessary to obtain effective algorithmic and computational knowledge to model parametric 3D shapes. For this particular class, the participants will be using Architectural and Industrial Designers models as their main 3D geometry.

Total number of hours 40, 8 hours each day.

Course summary, part I [Rhino]

- Review the interface of Rhino and its toolbars
- Introduction to how to draw in 2D
- Introduction to Curve Editing
- Basic Transform commands
- Surfaces, UV and Topologies
- Edit Surfaces
- History with some commands
- Curves from Objects
- Analysis
- Solids and How to edit Solids
- UDT Universal Deformation Tools
- Edit control points
- Nesting, Optimize your area and materials
- Print to Scale, Paper Space - Model Space
- Print to a Laser machine or a CNC machine

Download + Learning Material

- Download Rhino 5.0
- Grasshopper3D
- Watch the GH video tutorials
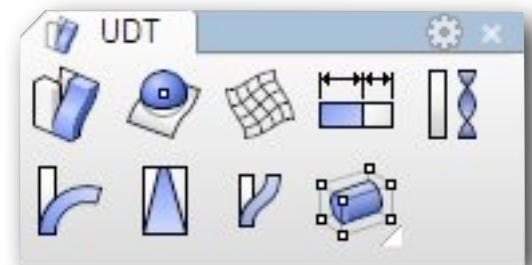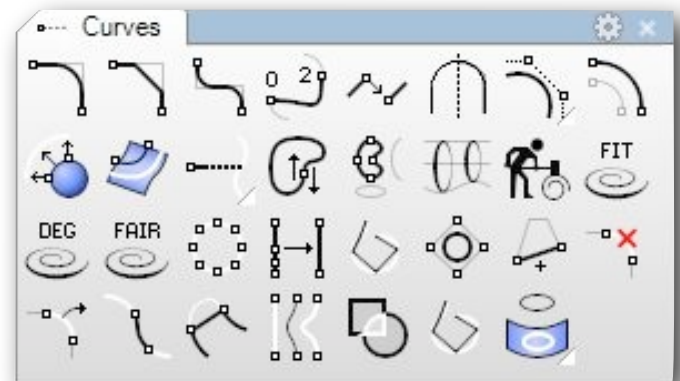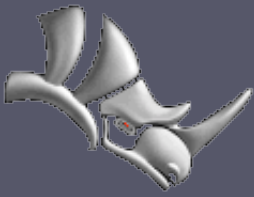
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Target Audience

This course is for the designer or professional who wants to efficiently learn the concepts and features of Rhino, knowing that the next step is to learn and use Grasshopper for designing Parametric 3D Models for Digital Fabrication.
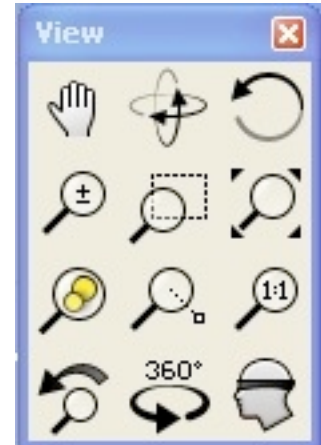
Day 1 [0-4 Hours, Rhino Part I]
• Review Rhino's interface and its workflow
• Quick demo of what you can do with Rhino and can't
• Introduction to Zoom, Pan, Open Files, and Selecting Objects etc
• Introduction to 2D drawing with Lines, Circles, Arcs etc.
• Understand the 3D elevator mode in Rhino

Day 1 [4-8 Hours, Rhino Part I]
• Draw 2D and 3D with Control and Interpolated curves
• Introduction to Polar, Rectangular and Absolute coordinates
• Layers, Make, Name, Color, Type of Lines etc
• Permanent Osnaps and one time only Osnaps
• Edit curves, Blend, Fillet, Refit, Chamfer, and Check the Topology etc
• Cplanes, Sections, Orient, Scale, Rotale and Remap Cplanes
• Start to write a ZUDO CODE of some basic shapes in order to be more prepared for Grasshopper Part II of the work-shop

Day 2 [0-4 Hours, Rhino Part I]
• Introduction to many transform commands
• Copy, Move, Scale, Remap, Array, Orient, Bend, Flow etc
• Introduction to some Surface commands
• Sweep 2 rails, Extrude, Planar, Rail Revolve, Loft etc
• Edit Surfaces
• Extend, Blend, Match, Unroll, Symmetry, Rebuilt etc
• UDT, Twist, Bend, Taper, Flow, Splop, Cage Edit etc
• Learn many tools to Analyze objects
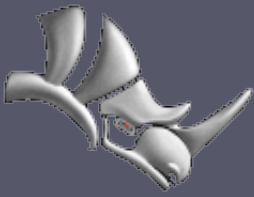
Day 2 [4-8 Hours, Rhino Part I]

- Edit Surfaces
- Extend, Blend, Match, Unroll, Symmetry, Rebuilt etc
- UDT, Twist, Bend, Taper, Flow, Splop, Cage Edit etc
- Learn many tools to Analyze objectsDay 3 [0-4 Hours, Rhino Part I]
- More advanced transformation tools like, Remap to CPlanes, Twist, Bend, Flow Along curve, Shear etc..
- Some commands work with History, some do not!
- Free Form Editing with Control Points, Insert Knot, Move UVN etc
- Construction Planes
- Model Units and Page Units
- Layers, Objects Layers, Duplicate, Copy Objects to etc
- Edit curves, Refit, Curve Boolean, Closed Seams, Convert to Arcs or Polylines etc
- Write more ZUDO CODE of some basic shapes in order to be more prepared for the Grasshopper Part II of the work-shop
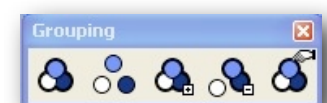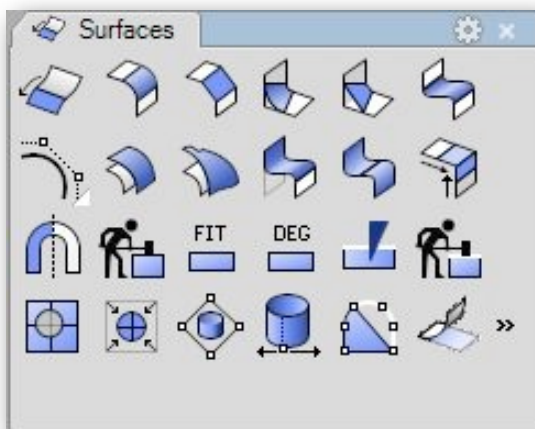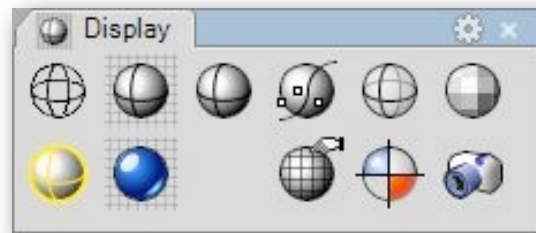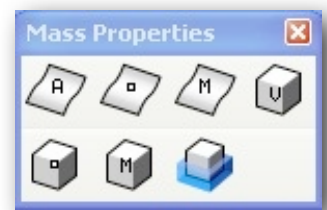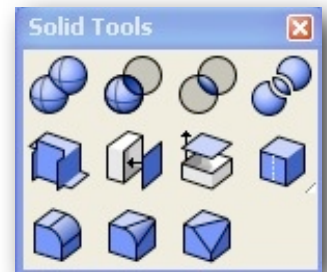
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Course summary, part II [GH]

- Review the interface of GH
- Introduction to Parameters
- Introduction to Set Components
- Math Components
- Explain Vectors Components
- Introduction to some of the Curves Components.
- Write the first algorithmic SUDO CODE definition to represent our first 3D building
- Introduction to Surface Components
- Understand intersection in 2D and 3D space.
- Introduction to some Transform Components
- Draw / Write some definitions describing few 3D Models and Generative Designs
- Bake your own 3D geometry and print it.
- Check the tolerances of some materials
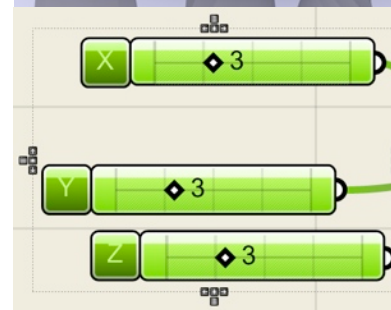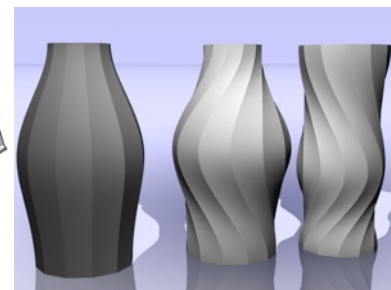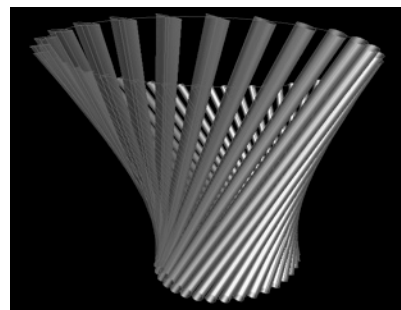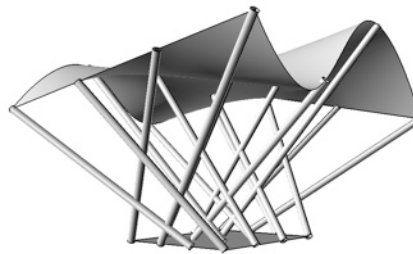- Print to scale to a Laser or Plotter some definitions
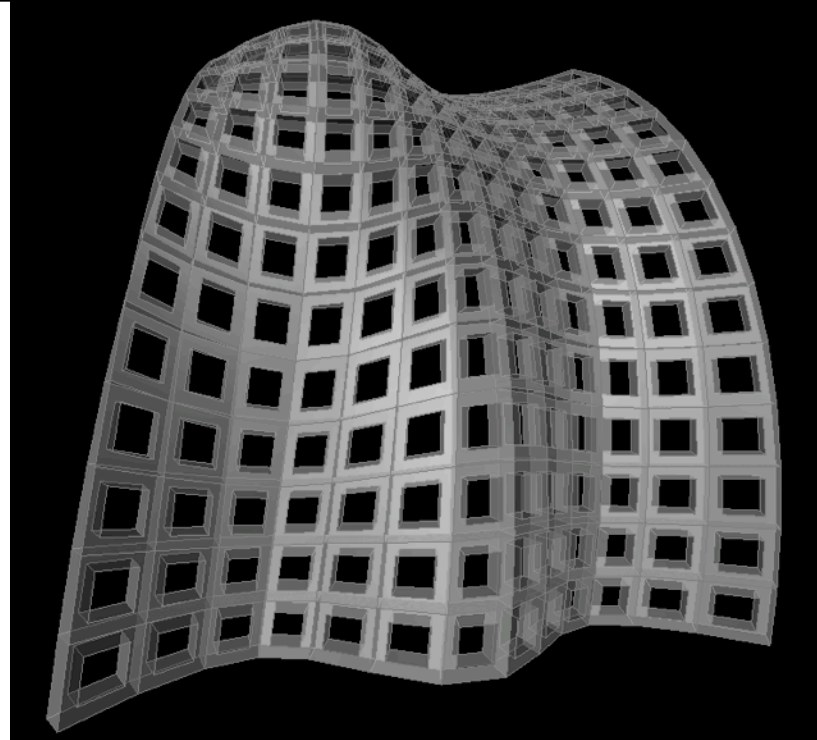
Assumptions

- Knowledge of Rhino 4.0 or 5.0 modeling environment [Part I of this Work-Shop]
- Knowledge of some basic math
- Windows XP or 7 skills or higher

Download + Learning Material

- Download Rhino 5.0
- Grasshopper3D
- Watch the GH video tutorials

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Target Audience

This course is for the design professional who wants to efficiently learn the concepts and features of Grasshopper and Digital Fabrication methods at an accelerated pace in an instructor-lead environment.

Day 3 [0-4 Hours] = MANDATORY!
• Unroll, Squish, types of lines and 2D printing
• The interface of GH and workflow
• Introduction to Parameters, short lists. Long and multi lists
• Whole numbers, Decimal numbers and the Numeric Slider
• Introduction to Logic "Sets" components
• Shift, Length, Sort, Split and Reverse
•

Day 3 [4-8 Hours]
• Series, Range, Cull Nth, Patterns and Shift, Loft and Bake
• Introduction to Scalar "Math" components
• Math functions like, Sin, Cos, and Tan
• 2D Intervals, Max and Min components and Merge and Dispatch

Day 4 [0-4 Hours]
• Introduction to Vector components
• Unit Vectors, Planes XY, XZ, YZ, Normal, Grid and Text 3D Tag
• Curve Components, like Line, 3Points, Circle CNR
• Divide, Length, Curve Frames, Fillet, Offset and Project

Day 4 [4-8 Hours]
• Surface, Intersect and XForm components
• Intersect Components like CCX, SCX, BCX and BPX
• Surface Components like Eval UV, Isotrim, Offset
• XForm components like Mirror, Move, Scale. Morph, Orient etc
• Introduction to RhinoCAM and the Nesting Plug-in Rhino
• Render and present your GH 3D model at the end of the workshop
• Fabricate one of your GH Definitions
• Post your work at www.RhinoFabLab.com
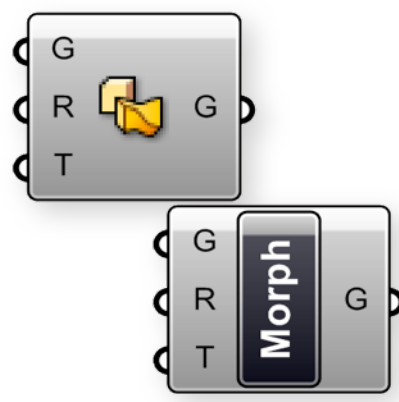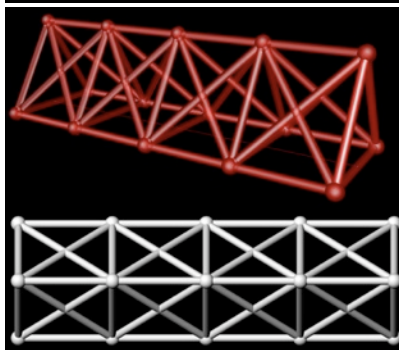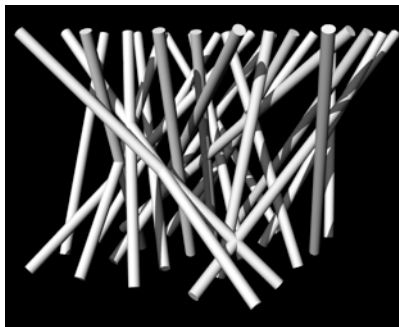
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Course summary, part III [CAM]

- Review the interface of RhinoCAM
- Introduction to 2 1/2 and 3 axis milling operations
- Introduction to RhinoCAM's Nesting Plug-in

Day 5 [0-4 Hours] = RhinoCAM!

- Some basic terms and workflows about CAM / CNC
- Select your Machine
- How to select your Post Processor [Machine]
- Set up the Machine orientation
- How to make the Stock
- Align stock and Part
- Choose your material
- 2 Axis Profiling + Engraving + Pocketing + Hole operations.

Day 5 [4-8 Hours]

- 3 Axis Horizontal Roughing
- 3 Axis Parallel Finishing
- Hands on with a real project!
- Cut, cur cut on a Laser or CNC machine...